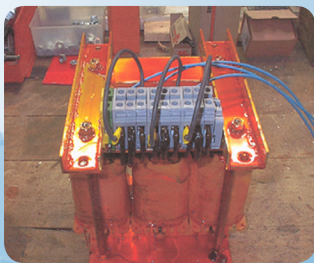


Transformers and Inductances

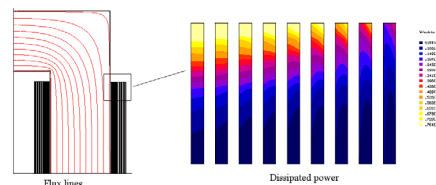


Depending on its size and application, transformer design and analysis depend on many different constraints. **CEDRAT** offers a wide range of solutions for the analysis of transformers and inductances in various situations.

Transformer design & analysis

For transformer modelling, **Flux** features numerous tools and capabilities allowing a precise and efficient computation. Dedicated to 2D and 3D electromagnetic and thermal finite elements analysis, **Flux** enables to simulate electric, magnetic and thermal behaviour of the device.

Both harmonic (sinusoidal steady state) and transient computation can take into account the supply, the loads (balanced or unbalanced) and the connections between the different conductors.



Power dissipation in the coils of a transformer, modelled with solid conductors.

WEB LINKS

Current transformer

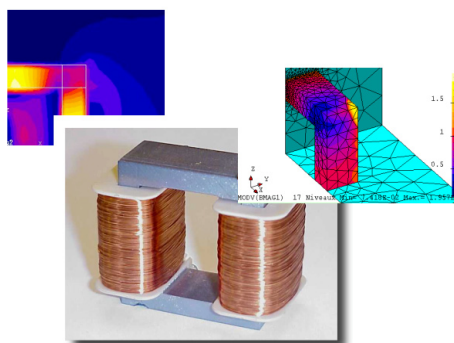
Magnetising coil

Power transformer

Power inductor

Drive analysis

Network embedding



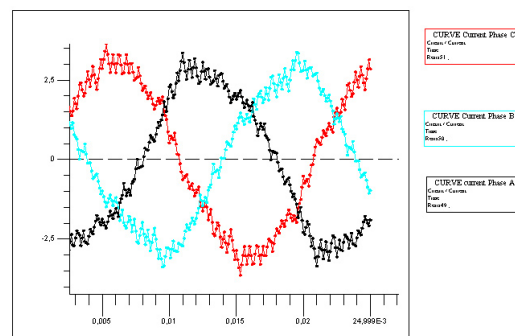
Current transformer modelled in 3D with **Flux**, flux density map (courtesy of Schneider Electric).

Thanks to a close coupling with an electrical circuit, it is possible to introduce various electrical components in the model (such as diodes, switches, inductors...) as well as special **Flux** features for coils modelling: stranded and solid conductors. Those special components can model either wounded coils or conductors where eddy currents and skin effects are sizeable.

Flux multiparametric postprocessor gives an easy access to a tremendous amount of results such as:

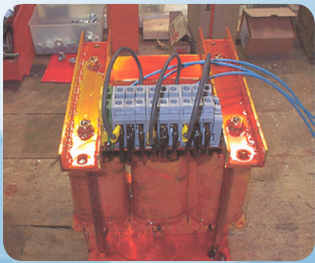
- Magnetic quantities in all the magnetic parts (flux, permeability...)
- Electrical quantities in the coils as well as in all the components modelling the supply and the loads.
- Power balance: power dissipation in the different parts of the geometry as well as iron losses in the core...
- Force on coils
- Spectrum analysis of any quantity
- Computations on various supports: paths, grids, groups of regions...

All those results are presented in various formats: colour-shaded or isovalues graphs and animations, 2D and 3D curves, local or global computations, export to office software.



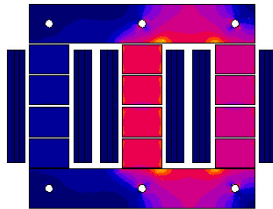
Phase currents out of a PWM supplied filter reactor.

Transformers and Inductances

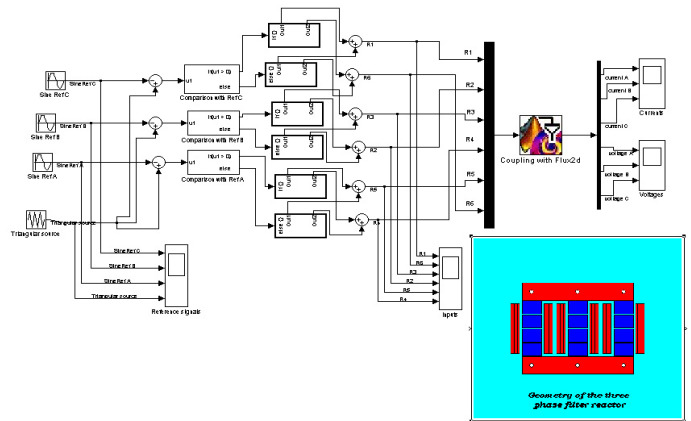


Driving a transformer or an inductance

The transient behaviour of a transformer is widely dependent on its drive. Modelling then both the device and its drive gives a better prediction of the behaviour. The association of **Flux** (for transient electromagnetic computation) and **SIMULINK** (for drive and control) gave birth to the most advanced tool for system design. Thanks to its co-simulation capabilities, **Flux to SIMULINK Technology** enables to account for saturation and eddy currents as well as control loops within the same simulation run.



SIMULINK model of a PWM supplied three-phase filter reactor using FLUX to SIMULINK Technology and flux density distribution.



WEB LINKS

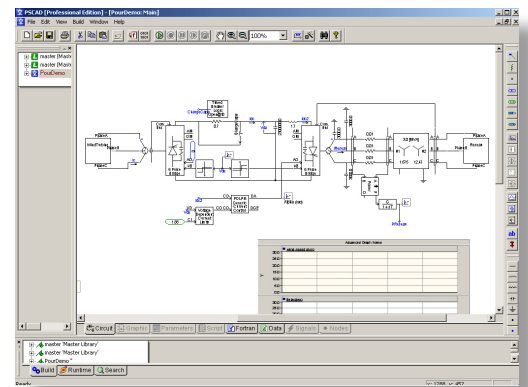
Flux for electromagnetic & thermal design

Flux to SIMULINK Technology for drive analysis

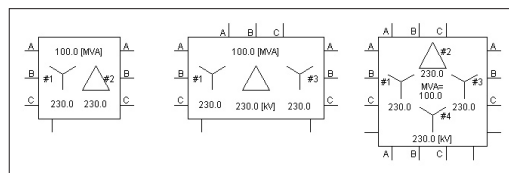
PSCAD for network analysis

Electrical networks including transformers

Do you want to study a whole network including transformers? **PSCAD**, the power systems simulator, features advanced models to simulate various kinds of transformers (single or three phases up to 4 windings, current or coupled capacitor voltage transformer, mutually coupled coils...). As any component of **PSCAD**'s library, the transformer components can be fully parameterised to simulate as accurately as possible its behaviour in the network.



PSCAD model of a wind farm connected to the grid via an isolating transformer



Various types of transformers models are available in PSCAD.

References

For various application, CEDRAT solutions are the reference in many organisations worldwide:

ABB Secheron, Alstom, Electricité De France (quality assurance contract), Federal Mogul, General Electric, Hydro Quebec, Korean Electrotechnology Research Institute, Iskra Stikala, Schneider Electric (official software) including companies as France Transfo & Jeumont Schneider transformateurs, Trafomec, Trasfor, Université Libre de Bruxelles, VATEch, Westinghouse.